OT&E in a Non-DoD Setting: Civil Aviation Security

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Bombs in Checked Baggage

- 1985 Destruction of Air India flight led to passenger-bag match as international standard.
- United States, taking a belt ***and*** suspenders approach, began development of ***automatic*** explosives detection systems for checked baggage. (Ordinary X-ray sets were inadequate.)
- Most promising technology: Thermal Neutron Activation (TNA).

PanAm 103 President's Commission: Findings on Explosives Detectors

- TNA's target mass of explosives ***twice*** the mass of PA 103 bomb.
- Need for independently, objectively derived standards.
- Need for independent testing.

Av. Sec. Act, 1990: Explosives Detection System (EDS) Performance Standard

- FAA shall ***not*** require airlines to buy and use EDS (for checked baggage) unless they are certified as:

  -- Capable of detecting the explosives likely to be used by terrorists,

  -- In the least quantity needed to cause catastrophic damage to an airliner,

EDS Standard (Continued)

-- On the basis of tests developed with the assistance of outside experts, and overseen by them.

- An incidental requirement: qualification of simulants for factory and airport testing.

Types of Explosives Detectors: R&D Challenges

- Vapor. Problem: very low vapor pressure of plastic explosives.
- Particle. Problem: difficulty of gathering a detectable sample.
- Bulk. Problem: small explosive mass in undefined configuration, physical similarity to innocuous materials in bags; “toothpick in a haystack”.

Bulk EDS Performance Testing Challenges

- Testing categories: Detection rate, False positive rate, Throughput (bags screened per hour).
- Testing safely with live explosives in many configurations and positions within bags.
- Representative bag sets.
- Level playing field for successive tests of many candidate EDS.

The Independent Experts

- Study by Committee on Commercial Aviation Security, National Materials Advisory Board, National Research Council, headed by John Baldeschwieler and Michael Story, 1993.
- Test protocols (statistically based) further developed -- and test overseen -- by Joe Navarro, and later by Jim O'Bryon.

Establishing EDS Standard

- Formal process, with public comment.
- Classified portions of proposed standard released to cleared entities with need to know. Separate channel for classified comments.
- Standard made final in 1993.
- Detonator detection standard added in 1998.

Certification Test Bed

- Location: FAA Technical Center, Atlantic City.
- Paul Polski, Avsec R&D Division Manager.
- Lok Koo, Test Director.
- Construction of test lab, magazines, storage for 6000 bags.
- Ready for certification testing in 1993.

EDS Certification Path

- Company (US or foreign) designs and builds EDS, under contract, grant, or CRADA with FAA.
- Company brings EDS to FAA Security Lab (now TSL) for data collection with live explosives: 1-5 weeks, ~100 bags.
- Company collects data on ~ 4000 bags (winter and summer) in airport.

Certification Path (2)

- Company develops detection algorithms intensively, using collected bag and explosives data.
- Company conducts factory testing with simulants. Revises algorithms. Submits Qualification Data Package (QDP).
- If QDP is valid, TSL schedules "Readiness Test" and Certification Test.

Certification Path (3)

- Company's engineers participate in Readiness Testing with TSL program staff. It often shows that the machine is still not ready for certification testing.
- Certification testing is conducted by TSL (Lok Koo, Bill Petracci) overseen by outside independent test expert (Joe Navarro, Jim O'Bryon). If machine seems to have passed, verification -- and report -- takes ~ 30 days.

Certification Limits

- Certified EDS is usually a first production item. Stability, reliability, maintainability still to be demonstrated.
- Certification test measures only automatic performance. Resolution of alarm bags (15-30% of those screened) is a separate challenge, particularly for OT&E.

Certification History

- First certified: InVision CTX 5000, November 1994. Since joined by CTX –5500, 2500, 9000. Multiple upgrades required re-certification.
- L3 Examiner 6000 certified in 1998. Since joined by 3DX 6000SE, 3DX 1000, and VCT 30.
- To date only CT technology has passed cert. X-ray diffraction technology may soon also pass.

Future Certification Challenges

- Checkpoint EDS. Much progress on representative bag set.
- Explosive trace detectors (ETD), including portals. Test sample uniformity?
- Challenges diminished by US Government (TSA) becoming the purchaser, instead of airlines.

Alternative Approach: Europe

- Europe (ECAC) has accepted US EDS standard as a goal.
- UK in 1992-3 pragmatically accepted TNA's Pd as its standard, permitting rapid progress in checked baggage screening, using dual energy fast automatic x-ray "EDD". Rest of Europe followed.